day 49

$\ln(x^2) = \frac{1}{x^2} \cdot \frac{d}{dx}(x^2)$ → NOT "x" so chain rule

$= \frac{1}{x^2}(2x) = \frac{2x}{x^2} = \frac{2}{x}$

LOG RULE

$\ln(x^2) = 2\ln x = \frac{2}{x}$

$\log_2 a = b$

$\Updownarrow$

$2^b = a$

$\ln(2^b) = \ln(a)$

$b \ln 2 = \ln a$

$b = \frac{\ln a}{\ln 2}$

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day 49

3.9/84 graph $y = \cos x \cdot \ln(\cos^2 x)$ ★product not simple "x"

7 horizontal tangents on $[0, 2\pi]$

★domain: $\cos x \neq 0$, $x \neq \frac{\pi}{2}, \frac{3\pi}{2}$

1) find derivative [the function that tells us what slope is...]

$y' = \frac{d}{dx}(\cos x) \cdot \ln(\cos^2 x) + \cos x \left[2 \frac{d}{dx}(\ln(\cos x)) \right]$

$= (-\sin x) \cdot (2 \ln(\cos x)) + 2\cos x \left[\frac{1}{\cos x} \cdot \frac{d}{dx}(\cos x) \right]$

$= -2 \sin x \cdot \ln(\cos x) + \frac{2\cos x}{\cos x}(-\sin x)$

$= -2\sin(x)\left[\ln(\cos x) + 1 \right]$

if $\cos x > 0$ then $|\cos x| = \cos x$

if $\cos x < 0$ then $|\cos x| = -\cos x$

step 2 set derivative = 0

$-2\sin x \left[\ln(\cos x) + 1 \right] = 0$

$\ln(\cos x) + 1 = 0$

$\ln(\cos x) = -1 \Rightarrow \cos x = \frac{1}{e}$ (e^{-1})

$x = \cos^{-1}\left(\frac{1}{e}\right), 2\pi - \cos^{-1}\left(\frac{1}{e}\right)$

$\sin x \Rightarrow x = 0, \pi, 2\pi$

+ 2 problems:

$\cos x \leq 0$

$\frac{d}{dx}(n) =$

$-2\sin x \left[\ln(\cos x) - 1 \right]$

$\ln(\cos x) - 1 = 0$

$\ln(\cos x) = 1$

$\cos x = e$ ⊗

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3.9/84) $y = \cos x \cdot \ln(\cos x)^2$ $(\cos x)^2 = |\cos x|^2$ day 49

$y' = (-\sin x)\cdot \ln\cos^2 x + \cos x\left[\frac{1}{\cos^2 x}(2|\cos x|)(-\sin x)\right]$

$= -\sin x\left[\ln\cos^2 x + 2\frac{|\cos x|}{\cos x}\right)$

↳ +1 or −1 depending on sign of $\cos x$

$\sin x = 0 \Rightarrow x = 0, \pi, 2\pi$

$\ln\cos^2 x + 2 \Rightarrow \ln\cos^2(x) = -2$

$\cos^2 x = \frac{1}{e^2} \Rightarrow \cos x = \frac{1}{e}$ OR $\cos x = -\frac{1}{e}$

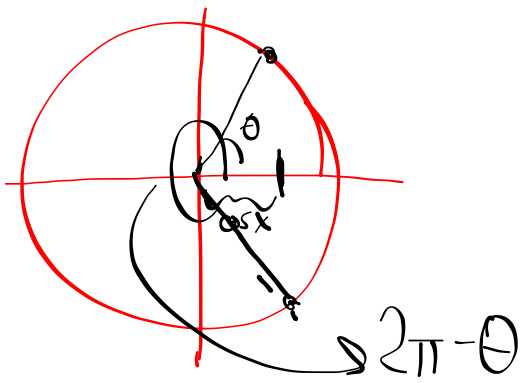
$\Rightarrow x = \cos^{-1}\left(\frac{1}{e}\right)$ → AND $2\pi - \ldots$

OR $x = \cos^{-1}\left(-\frac{1}{e}\right)$

↳ AND $2\pi - \ldots$

$\ln\cos^2 x - 2 \Rightarrow \ln(\cos^2 x) = +2$

$\Rightarrow \cos^2 x = e^2 \Rightarrow \cos x = e$ ∅



day 49

3.9/74 $y = (x^2+1)^x = e^{\ln(x^2+1)^x} = e^{x\ln(x^2+1)}$

b

$y' = e^{x\ln(x^2+1)} \cdot \frac{d}{dx}\left(x\ln(x^2+1)\right)$

$= \Downarrow \cdot \left[1\cdot\ln(x^2+1) + x\left(\frac{1}{x^2+1}\right)\cdot 2x\right]$

$= (x^2+1)^x\left[\ln(x^2+1) + \frac{2x^2}{x^2+1}\right]$

$\ln y = x\ln(x^2+1)$

$\frac{1}{y}\frac{dy}{dx} = \ln(x^2+1) + x\left(\frac{1}{x^2+1}(2x)\right)$

$\frac{dy}{dx} = y\left[\ln(x^2+1) + \frac{2x^2}{x^2+1}\right]$